

# Forecasting Winter Air Quality Over Greater Montreal

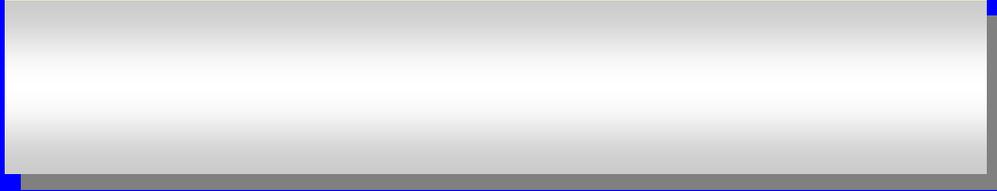
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Meteorological Service of Canada – Quebec region

Baltimore February 24, 2004

# Outline

- Background
- Observation Site
- PM<sub>2.5</sub> & Meteorology
- Model
- Results
- Future Work
- Conclusion

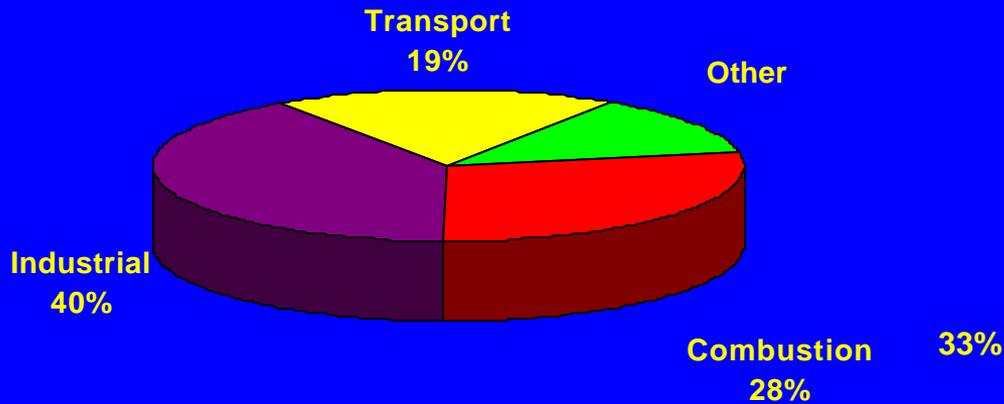


# Forecasting Winter Air Quality

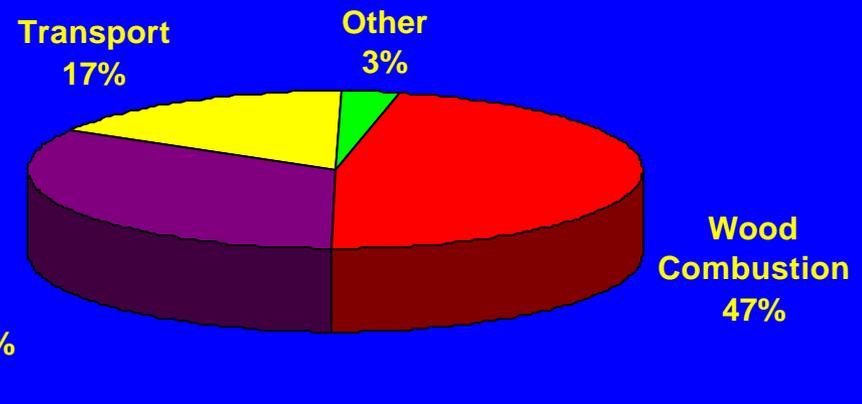
- Request from Montréal Urban Community (1998)
- Wood smoke campaign (98-99)
- Field study (winters 98-99, 99-00)
- Pilot Project Dispersion forecast (winter 00-01)
- Winter INFO-SMOG Air quality forecast (winter 01-02)  
(winter 02-03)  
(winter 03-04)



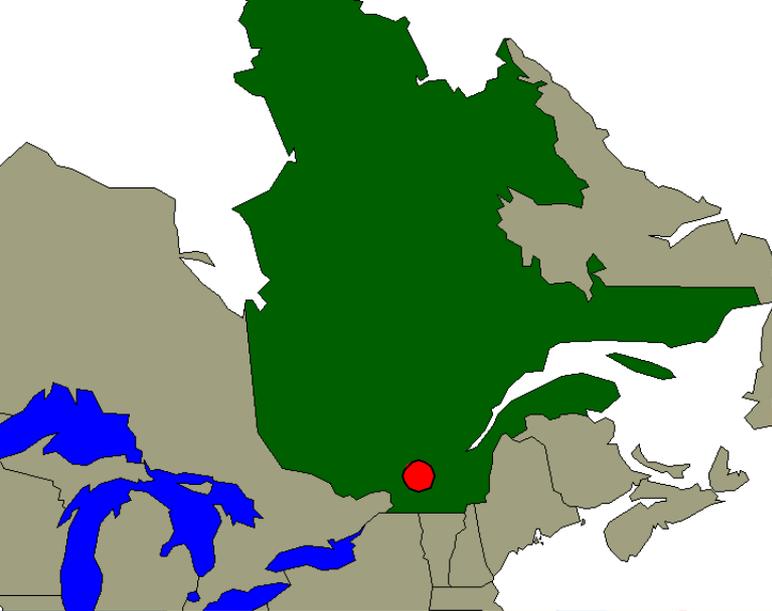
## Canada



## Quebec



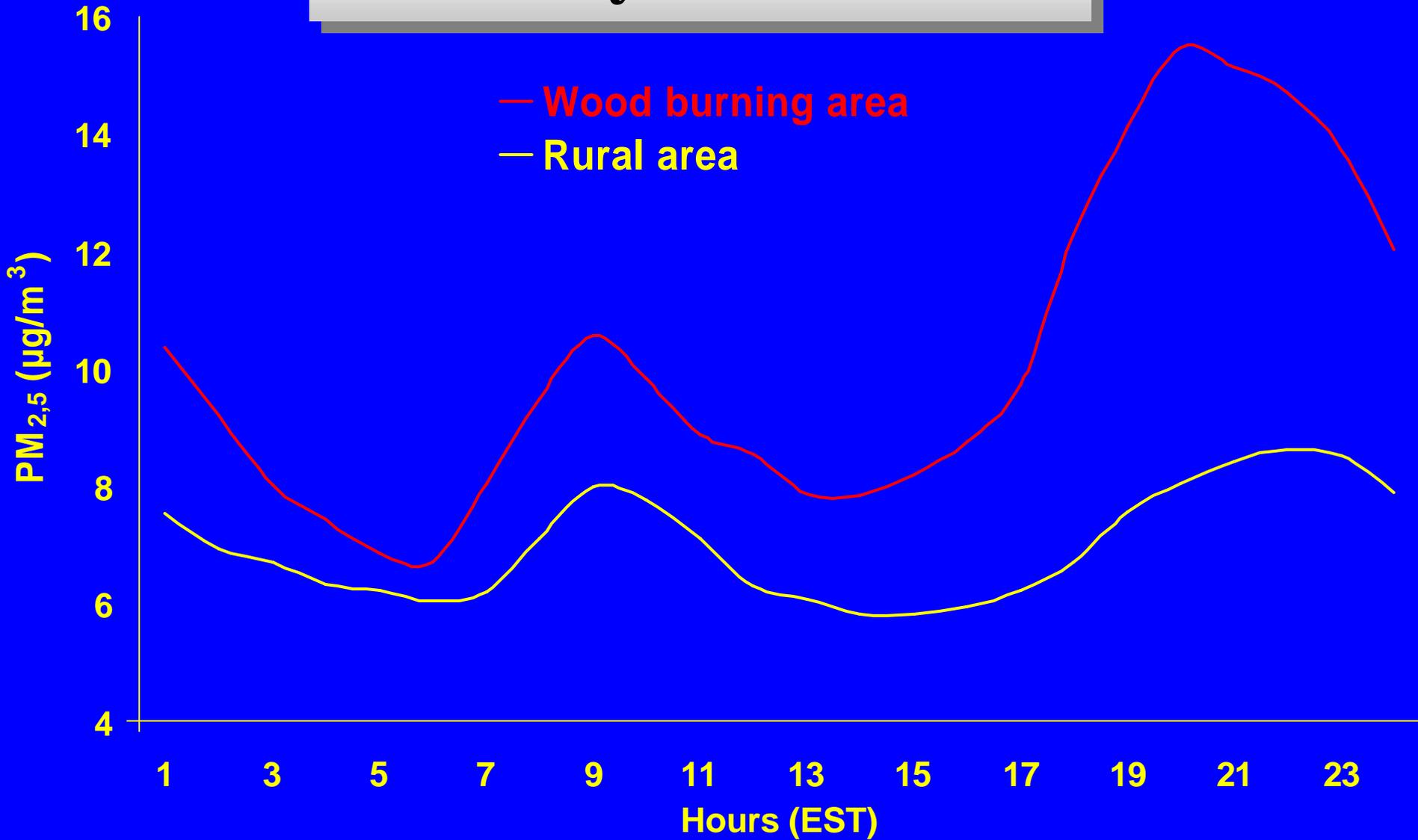
**Total Canada 2000 PM<sub>2.5</sub> Emissions = 404 Kilotonnes**

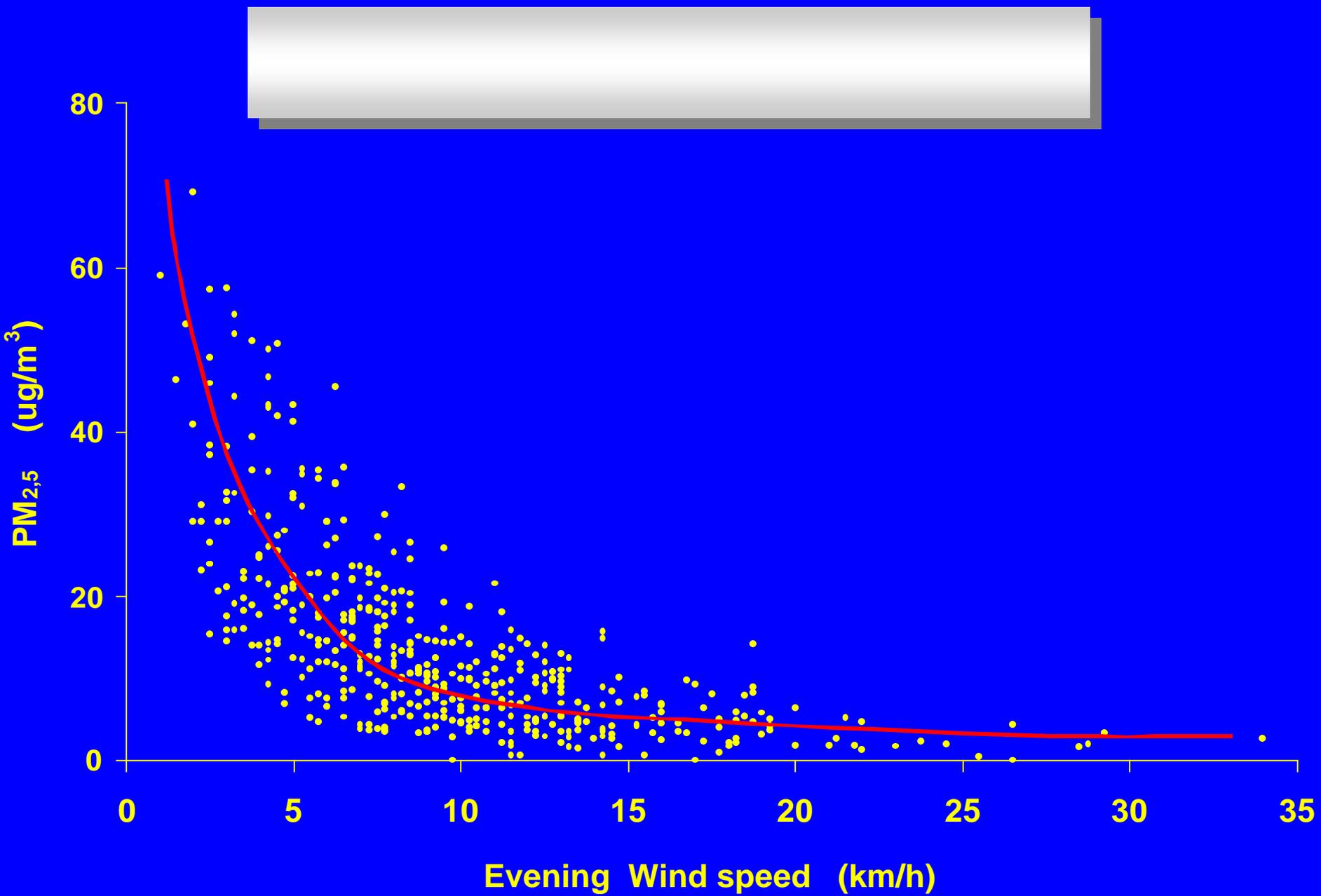


# Measurement Site



# Hourly Variation





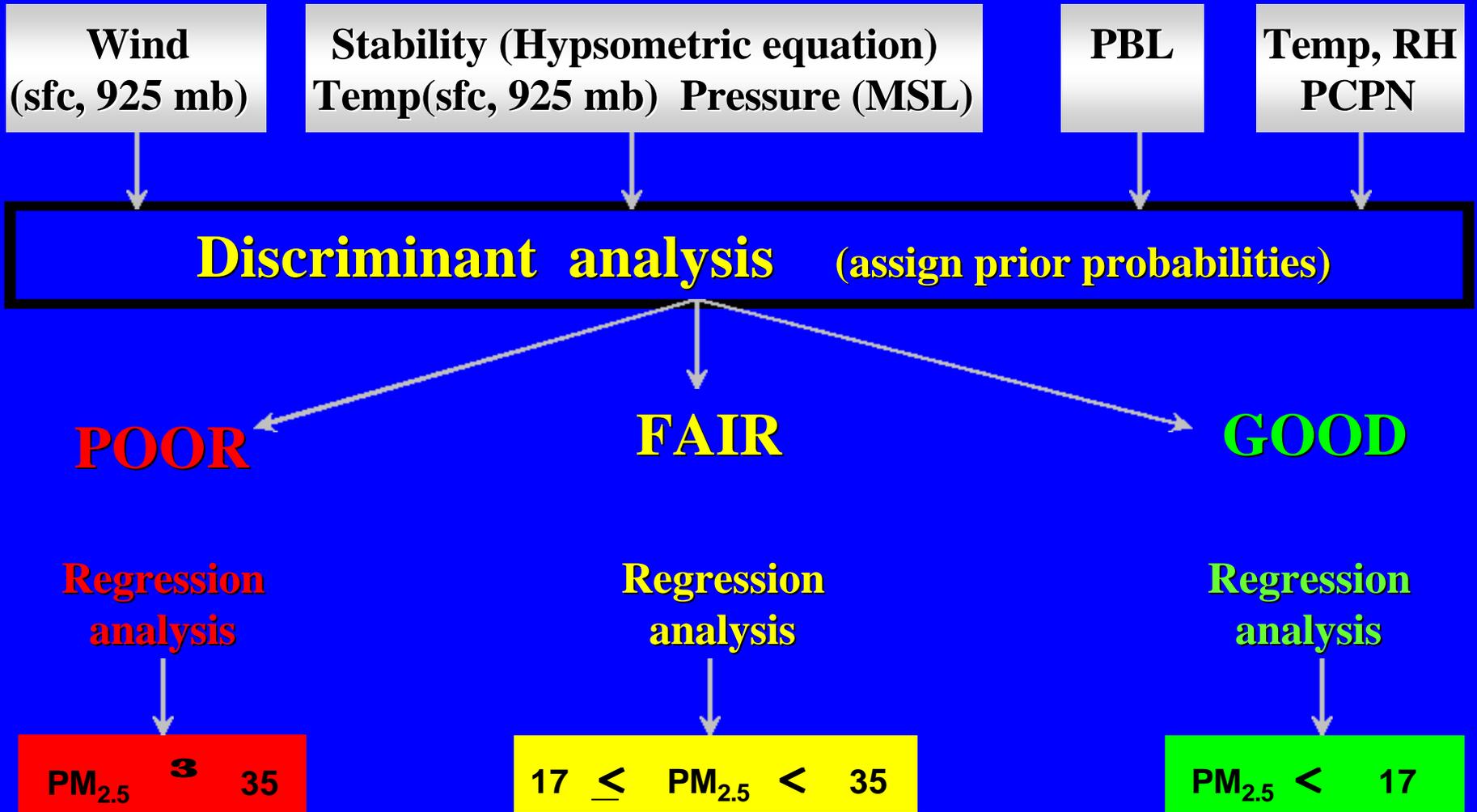
# **Meteorological conditions leading to high [PM<sub>2.5</sub>]**

- **Weak surface gradient (low wind speeds)**
- **Low mixing height value**
- **Temperature inversion (stable condition)**
- **Ahead of warm front**
- **Back of high-pressure system**

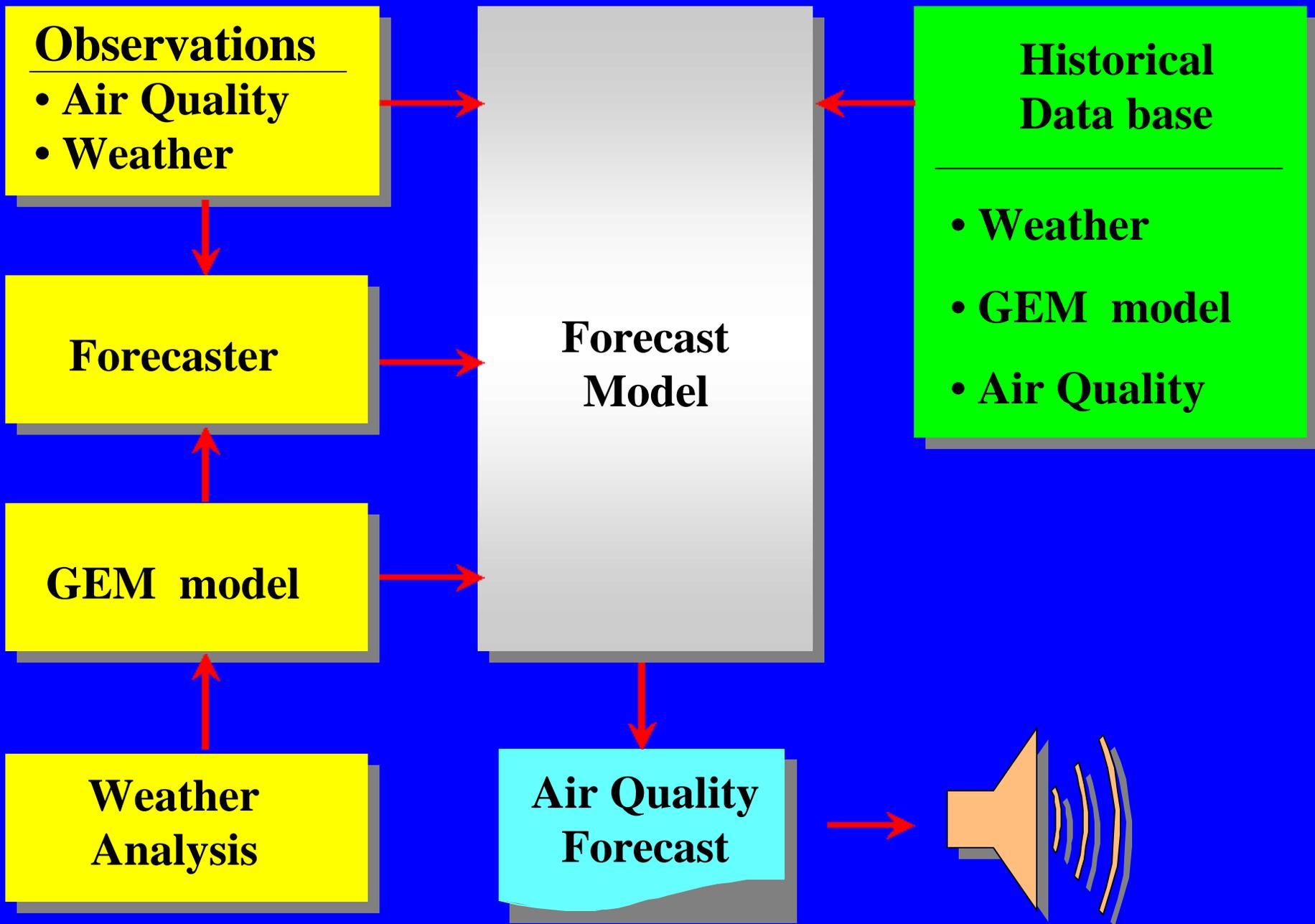
# Forecast model based on :

<b>Parameters</b>	<b>Time period</b>	<b>Correlation (r) PM<sub>2.5</sub> &amp; Parameters</b>
<b>Surface wind speed (Km/h)</b>	<b>Evening average</b>	<b>-0,74</b>
<b>Boundary layer height (m)</b>	<b>00Z</b>	<b>-0,69</b>
<b>Vertical stability (°C/m)</b>	<b>00Z</b>	<b>-0,50</b>
<b>ΔT (°C)</b>	<b>24 hours</b>	<b>0,38</b>
<b>925 mb wind speed (Km/h)</b>	<b>00Z</b>	<b>-0,36</b>
<b>Precipitation (mm)</b>	<b>24 hours</b>	<b>-0,35</b>
<b>Surface temperature (°C)</b>	<b>12Z</b>	<b>-0,33</b>
<b>Relative humidity (%)</b>	<b>Evening average</b>	<b>-0,27</b>

# Model



**Model Accuracy = 81,6 %**



# Parameters Input

- Evening SFC wind
- Evening SFC temperature
- Maximum SFC temperature
- Amount of precipitation

Forecaster

- Boundary layer height
- Temperature at 925 mb
- MSL Pressure
- Wind at 925 mb
- Relative Humidity

GEM Model

- Minimum SFC temperature
- Morning SFC temperature

Observations

# Diffusion

- \* **Environment Canada forecast bulletins**
  - \* **WEB** (ex : Montreal urban community)
  - \* **E-mail** (ex : Public health department )
  - \* **Auto-Fax** (ex : Health lines)
- 
- **Appropriate health and environmental messages for each forecast categories**

# Forecast verification

Winter 2002 - 2003

## Forecast

Observation

	Good	Fair	Poor	Total
Good	53	17	1	71
Fair	2	27	8	37
Poor	0	4	8	12
Total	55	48	17	120

# Performance results

	Good	Fair	Poor	Overall
PA	96 %	56 %	47 %	79 %
POD	75 %	73 %	67 %	73 %
FAR	4 %	44 %	53 %	21 %

**PA** : Measures the percentage of events correctly forecasted

**POD** : Measures the percentage of events correctly detected

**FAR** : Measures the tendency to over forecast

# Future work

- **Extend forecast to others regions**
- **Day 2 forecast**
- **Take account for long range transportation**
- **Increase visibility to the public**

# Conclusion

- **Weather : the main driver to explain pollutants behaviour**
- **Multi-sources pollutants (widespread sources over area)**
- **Pollutants are mainly local (no significant transport)**
- **Steady emission over long time period (day after day)**
- **Low altitude emission (no high stack)**

**<http://www.qc.ec.gc.ca/atmos/smog>**

3<sup>rd</sup> Canadian Workshop  
on Air Quality



March 24-26, 2004  
Quebec City

# Pollutants across boundaries

- Modelling
- Monitoring & Analysis
- Society
- Science & Policies
- Regional Programs

<http://aqworkshop.ec.gc.ca>

Info : [aqa@odon.ca](mailto:aqa@odon.ca)